VOL. ~~XLI~~ XIII NO. 3

THE CALIFORNIA ECLECTIC MEDICAL JOURNAL

Incorporating
THE LOS ANGELES JOURNAL OF ECLECTIC MEDICINE
AND THE CALIFORNIA MEDICAL JOURNAL

ISSUED MONTHLY

MARCH, 1920

O. C. WELBOURN, A. M., M. D., Editor
819 Security Building, LOS ANGELES, CAL.

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SUMMARY OF REPORTS
FROM ONE THOUSAND PHYSICIANS

Remedies named as most useful in INFLUENZA		Remedies named as most useful in PNEUMONIA	
Aconite	788	Bryonia	723
Gelsemium	772	Aconite	617
Bryonia	707	Veratrum	576
Macrotys	384	Lobelia	468
Veratrum	353	Ipecac	411
Eupatorium	328	Asclepias	366
Lobelia	324	Gelsemium	293
Asclepias	268	Belladonna	169
Ipecac	236	Sanguinaria	134

Many physicians found it impossible to name **any** remedy as of "most importance," stating, very truly, that **each** is "most important" when its use is indicated. Others named two or more as most serviceable, giving usually the conditions under which each was used. **For example,** "Gelsemium is most frequently indicated, but where **sepsis** is marked, Echafolta or Echinacea becomes most important." A typical answer, often made, is as follows: "In nearly every case I find indications for **three** remedies—Gelsemium, Macrotys and Eupatorium." Again, "Aconite for fever, Eupatorium for bone-ache, and Macrotys for muscular soreness."

EXTERNAL APPLICATIONS

Libradol	618	Camphorated Oil	62
Compound Emetic Powder	185	Onion Poultice	38
Turpentine Applications	110	Iodine Applications	14
Antiphlogistine	96	Scattering	120
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Under "Scattering," are included many private prescriptions, as well as such applications as "mush jacket," "flaxseed poultice," "quinine and lard," and one each of the following: "capsicum, mustard and tar," "tobacco and wheat flour," "snuff and black pepper." "Dry cupping" finds one advocate.

It is often stated: "When I cannot get Libradol I use the best attainable substitute," hence many of the above may be considered as emergency applications.

Respectfully,

LLOYD BROTHERS.

Cincinnati, Ohio, March, 1919.

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The California Eclectic Medical Journal

Vol. ~~XLIX~~ LXII MARCH, 1920 No. 3

:: Original Contributions ::

THE MUNK BOTANICAL GARDEN AND ARBORETUM

J. A. Munk, M.D., Los Angeles, California

In 1906 I started a botanical garden for growing domestic medicinal herbs, in order to find out how plants from other states would act when transferred to California soil and climate. Some native medicinal plants, like Anemopsis and Rhammus Californica, were already established on the ground when the garden was begun, and these were allowed to remain to help give variety to the collection. Later on the experiment was extended to include many eastern forest trees and shrubs.

The place chosen for making the trial was an eight-acre lot near the village of Compton, in an agricultural district half-way between Los Angeles and Long Beach. The ground selected is on an alluvial plain, seventy-six feet above tide-water. The soil is a rich, sandy loam, filled with fine bits of mica and some alkali in spots. Not a grain or coarse sand or gravel, nor a piece of any kind of rock, unless imported, is found over an area of many miles.

The locality has the benefit of the daily cool sea breeze from the Pacific ocean during the summer months, and an occasional touch of frost in the winter. The frost seldom amounts to more than ten degrees, for a short time during the early morning hours, and rarely does any damage. The land lies midway between the frostless sea-shore and the foot-hill thermal belt. Apples are supposed to be benefited by a little frost, and they grow here to perfection, but citrus fruits thrive best where there is no frost.

At the time that the garden was begun, a professional friend from Topeka, Kansas, paid me a visit. After showing him over the place and explaining the project, he immediately

began to figure out my prospect of life, according to actuary rules, and decided that I was undertaking the enterprise too late in life to make it a success. However, I did not let his talk discourage me from going ahead, saying that even if the time were short the work gave me great pleasure in the joy of watching things grow; and although it might not benefit me, it would do somebody else some good after I was gone. He proved to be a poor prophet, as I have lived long enough to realize my expectations, while he departed this life many years ago.

As the trees now growing in Southern California are mostly evergreen, and imported from hot countries, I decided to make the test with deciduous trees from the temperate zone. When I began to inquire, I found that deciduous shade trees were scarce and could not be obtained in quantity in the local market. I succeeded in finding a few native poplars, sycamores and willows and with these I made a start.

I then sent east and procured an assortment of forest trees and shrubs from nurserymen and friends; also some new foreign varieties from the Bureau of Plant Industry. In planting the trees, I aimed to avoid any stereotyped method of arrangement, but distributed them at irregular intervals, to give the grove the appearance of a natural forest. I wanted to see how the trees would be affected by a change in local conditions and gave them only such attention as was necessary to give them a good start. They readily became established and grew rapidly, so that now after a lapse of twelve years some of the trees have attained a diameter of two feet and a height of one hundred feet, all covered by a thick canopy of dense foliage.

A winding brook meanders through the grove, with here and there a footpath leading to some favorite spot. The spaces of level bottom land, sloping banks, open swales and sequestered glades, covered with trees and shrubbery, give it the appearance of an eastern woodland. Many kinds of birds and some small four-footed wild creatures have been attracted to its shelter and have made it their sanctuary. The little animals are seldom seen as they usually travel at night, but the track of their nocturnal rambles are visible in the dust on the road and in the soft earth of the damp ditches.

An important ingredient of the soil to keep it in good condition is an adequate supply of water. In a country like California, where it does not rain during eight months of the year, water is an important factor and must be applied to the land artificially by irrigation, to make the soil productive.

This essential element is furnished by an artesian well which flows in a perennial stream without pumping. The water is conducted over the ground in ditches, by gravity flow, and is used whenever and wherever it is needed. When the water is not being used for irrigation, it is discharged by a spillway over rippling cascades as it falls from the higher level of the well to the lower level of the brook, where their waters commingle and flow onward to the sea.

One advantage of a dry country is that weeds do not grow and spread as in a wet country. No plant that is brought from the humid east, where it is accustomed to being drenched by rain every few days, can stand a prolonged drouth without dying. Naturally, some weeds must grow in every land, but those imported to the desert must first become desert bred in order to acquire the habit of drouth resistance. Otherwise they must be nursed with water and cultivated to be able to endure. However, plants sometimes change their habits and will adapt themselves to drouth so that they can live without much water. A familiar example of such a change in California is the common hoarhound (Marrubium vulgaris) which is an adopted child but flourishes as if it were a native of the soil.

Of all the forest trees experimented with, the Carolina poplar (Populus Carolinensis) is the favorite. It grows rapidly and is clean, tall and stately. Its foliage is glossy and sparkles in the sunlight! its leaves are scarcely ever still and have a musical rustle. It is handsome looking throughout the year, green in the spring and summer, yellow in the fall when its leaves show the autumn tints, and white in the winter when the bare branches are gracefully outlined against the blue sky. The treetop is the last to acquire leaves in the spring and the last to lose them in the fall. After most of the lower leaves have disappeared, the topmost branches stand up like flagstaffs, in a glorious array of shining yellow leaves, like an army with banners fluttering in the breeze. When the autumnal colors appear in the foliage the change is called oxidation, which is an effect rather than a cause and has no special significance except to indicate that the leaves have reached full maturity and passed into a state of decay. This action takes place en masse only in deciduous trees when they shed their leaves in the fall to carpet the ground in varying shades of russet and brown.

If at this time the weather happens to be hot and dry, the leaves do not show their usual bright colors but die and drop quickly. If the weather is cool, damp and cloudy, the colors

are noticeably brighter and the leaves adhere closely for some time, yet it all happens without any frost. In California the change occurs during the month of October, the same as in the east, and the appearance of such a grove in a California landscape is in striking contrast to the prevailing evergreen forests that have been introduced from Australia and other tropic lands.

Nature's arboreal pageant is a pleasing spectacle to contemplate. It begins early in the spring with the buds bursting into many kinds of leaves which spread a fresh green color over the trees like an emerald garment and marks the beginning of nature's annual carnival. The mild winter weather of the California summerland does not appear to hurry nature in the least. The trees remain dormant all winter long, until it is time for them to act, when suddenly the buds start to swell and grow and nothing can stop them. Nature's order of procedure is perfect and each variety of leaf and flower finds its particular place in the procession at precisely the right time to add its touch of color to the harmony of this wonderful panorama.

Yellow predominates in the colors of the autumn foliage, yet there are also bright splashes of red to be seen. The trees that are most conspicuous in yellow stand out in about the following order: Carolina poplar (Populus Carolinensis), yellow poplar (Liriodendron tulipifera), maple (Acer saachrium), ash (Fraxinus Americana), elm (Ulmus fulva), linden (Tilia Americana), and several kinds of nut trees; while the tallow tree (Sapium sebiferum), red oak (Quercus rubra), sweetgum (Liquidambar styraciflua), wahoo (Euonymus atropurpurens), staghorn sumach (Rhus hirta), poke root (Phytolacca decandra) are clothed in brilliant red as if growing on their native heath.

Starting a grove of deciduous forest trees seemed to be a necessary preliminary in preparing a suitable ground for the reception of eastern wildwoods plants, in order to provide them with their accustomed leaf mold and shade. Notwithstanding that this work was thoroughly done, the plants did not take kindly to the change and in most cases perished. My first order consisted of one hundred sets each of golden seal (Hydrastis Canadensis) and of ginseng (Panax quinquifolium) that had been propagated in an eastern nursery. They arrived in good condition, were carefully planted and made a good start. After several weeks had passed they were stricken with a blight that wilted them in one day, and only a few plants survived. The few that lived made a feeble effort to

grow the next year, surviving only a short time, when they, too, died.

Other woods plants were procured at different times direct from eastern collectors. They met a like fate and this was a sore disappointment. No sufficient cause could be ascribed for the failure, only that the plants did not seem to fit into their new environment. Some of these plants, as I now recall them were black cohosh (Cimicifuga racemosa), mayapple (Podophyllum peltatum), blood-root (Sanguinaria Canadensis), liverwort (Hepatica triloba), partridge berry (Mitchella repens), wild ginger (Asarum Canadensis), trailing arbutus (Epegea repens), wintergreen (Gaultheria procumbens), and yellow lady's slipper (Cypripedium pubescens).

About the same time a few periwinkle vines (Vinca minor) were planted in another section of the grove. These soon grew rank and spread rapidly by runners into a thick mat of vines that covered the ground. The plant seems to thrive in a soft bed of leaves and dense shade, which conditions appeared to be detrimental to the other plants as described above. It is an attractive midwinter cover crop, with its trailing vines, green leaves and blue flowers showing conspicuously among the gray trees and brown leaves of the forest. Of the climbing plants only three kinds lived and continued to endure. These were the wild yam (Dioscorea villosa), American ivy (Ampelopsis quinquifolium) and yellow parilla (Menispermum Canadensis).

The shrubs and herbaceous plants which were planted in the open garden fared better, and some of them have prospered exceedingly well. Among them are the spicebush (Larus benzoin), elderberry (Sambucus Canadensis), prickly ash (Xanthoxylum Americanum), bayberry (Mirica cerifera), black haw (Viburnum prunifolium), witch hazen (Hamamelis Virginica), pawpaw (Asimina triloba), English hawthorn (Crategas oxyacantha), Oregon grape (Berberis acquifolium), Apache plume (Fallugia paredoxa), green bells (Lycium pollidum), desert willow (Chilopsis linearis), Scotch broom (Cytisus scoparius), Canadian hemp (Apocynum cannabinum), queen of the meadow (Eupatorium purpurum), iron weed (Veronia Noveboracensis), Solomon's seal (Polygonatum bifeorum), boneset (Eupatorium perfoliatum), cranesbill (Geranium maculatum), butterfly weed (Asclepias tuberosa), Indian pink (Spigelia marilandica), spikenard (Aralia racemosa), mullein (Verbascum thapsus), and elecampane (Inula Helenium).

The plants mentioned above are only a few out of many

hundreds that grow in the garden, but are sufficient to denote the wide range of plant life which the garden produces. Some families of plants are represented by several different species, all manifesting similar peculiarities. There is every kind of mint, several kinds of sumach and dogwood, a dozen or more varieties of Berberis and a like number of golden rods.

Many of the plants show unusual vigor and are increased in size. As an illustration, take the iron weed which, as found growing in an eastern meadow, has a height of from three to four feet, while here it attains a height of from eight to ten feet, with a flower-head of deep purple blossoms as large as a water bucket. Another instance is the elder which in the east has a corymb of white flowers the size of a saucer, while here they are as big as a dinner plate. In protected places the bushes are loaded with fruit in season, but where the berries are exposed they are devoured by the greedy birds even before they are half ripe.

One reason for growing medicinal plants was to ascertain if their value as medicines would be impaired by the changed conditions of environment. They evidently lose none of their strength and if there is any difference it is in favor of an increased value.

HAY FEVER AND ITS TREATMENT

Dr. E. S. McClelland, Los Angeles

Read before the Los Angeles County Eclectic Medical Society

Hay fever is very closely related to asthma. Each has comparatively the same etiology. Each may manifest itself in an individual at the same time. Their pathology differs only in the parts of the body affected. Their signs and symptoms differ only because different organs are affected.

With the exception of rheumatism there is possibly no disease which has called forth so many forms of treatment, treatments reasonable and unreasonable, scientific and unscientific, but most unfortunate of all none are specific.

The treatment of hay fever by alcoholic injection is, properly speaking, unscientific, but if we consider the nature and pathology of the disease we can scarcely consider the treatment unreasonable. This treatment certainly gives satisfactory results in selected cases and so far as the writer knows it has never produced any ill effects, yet it might be considered presumptious to advocate such a method of treatment without first giving due consideration to what is popularly known as

the scientific means of treatment and offering reasons for not giving it preference.

Before discussion of the treatment of hay fever it may be well to briefly review the etiology. It is the concensus of opinion that hay fever has not only a predisposing but an exciting cause. A predisposing cause may be an inherited neurotic temperament or an occupation which wears on the nerves, or one which furnishes a sensitive spot, or the excessive use of a nerve stimulant, or a pathological condition of the nasal passages or a focal infection. These predisposing causes place the disease mostly among the educated, among the tradesmen and the professional, the highly sensitive, among social aspirants, among people who worry for any reason and among the delicate. It seems to be a disease of civilization. It is peculiarily rare among the lower classes. It is absent from the entire continents of Asia and Africa. Even the negro, and Jap and Chinaman of America have retained their immunity.

Focal infections are generally supposed to be the cause in most cases which occur at any season of the year. If it were possible for all focal infections to be removed a certain class of cases could possibly be eliminated, but unfortunately about 50% of all focal infections are beyond the reach of the surgeon, viz., in the lungs, and bacterial vaccines are far from specific.

An individual has inherited or acquired a predisposing cause, then there are literally hundreds of exciting causes which are capable of throwing this individual into the most violent attacks of Hay Fever or Asthma within a few minutes. The most common of these is the protein of the pollen of various forms of grasses, trees and weeds. The most common excitant of the largest early summer class is the pollen of grasses. The most common excitant of the large late summer group is the protein from the pollen of the compositae, as for example from the ragweed or golden-rod of the East. The protein of a vast number of foods act as exciting causes of this disease. The protein of many furs or feathers act with equal violence.

The writer now has a patient afflicted with both Hay Fever and Asthma whose exciting cause is the fur of a cat of any color or kind. In many cases the patient has become aware of some exciting cause. If the patient cannot furnish the physician with any information as to the exciting cause then the physician may find himself involved in a laborious task in diagnosing the exciting cause, which is necessary if he expects to use what we have honored by calling the strictly scientific or learned method of treatment.

There are two methods of approaching the diagnosis of the exciting cause. One comparatively simple called that of elimination, as for example a subject susceptible to a spring variety of pollen is seldom susceptible to a fall variety of pollen and vice versa, or a patient who is subject to Hay Fever at any time during the year is seldom susceptible to pollen of any kind.

The other method of diagnosis is that devised, I think, by Walker of Boston. This test is not so complicated, but hundreds of individual tests may be required in order to determine all the exciting causes. The technique of this test is similar to that of Von Pirquet test for tuberculosis except that a protein extract of some pollen, fur or feather is used instead of the tuberculin. Only one protein can be used at a time. A well equipped laboratory should contain about two hundred pollen protein alone. The same protein which is found to produce the required skin reaction is used as a vaccine for treatment. To apply this method here in California is out of the question as far as the protein of pollens are concerned. It is not advisable to use extracts or vaccines manufactured from eastern or middle western flora and as no pharmaceutical company on the Pacific Coast has yet been induced to attempt the manufacture of a necessary series of pollen extracts from either our native or our large variety of imported semi-tropical plants this method of diagnosis and treatment must be dismissed as impossible here. Even the extract from the giant eastern ragweed differs sufficiently from the protein of our dwarf ragweed to be of no use to the physician here in applying this method. People susceptible to the ragweed in the east as a rule escape the effect of the pollen of our dwarf ragweed here for the first few years after coming to this climate.

Diagnosis and treatment by food, fur, and feather protein is possible here as the material is accessible, but the process is expensive, tedious, requires months or years, is controverted by the danger of anaphylaxis or shock and is not specific. Often the long process of diagnosis by sensitization whereby the active exciting proteins are to be discovered, the process of immunization by ascending injections of a single extract during months without evident results is apt to discourage an individual, however enduring his patience and profound his faith in the one giving him such treatment. The basic principles of this method of treatment as laid down by Walker of Boston teach by a vast series of experiments that the use of a protein used for treatment which does not show itself an excitant in the diagnostic test must be expected to do actual

harm by sensitizing the patient to a new exciting cause if used for treatment. If this is true then we could not expect mixed stock proteins advertised by pharmaceutical houses to be of any use, but rather a source of danger even if made from our native pollen. If the diagnosis and treatment of Hay Fever by protein vaccines is not only impracticable but impossible here on the Pacific Coast on account of the absence of material, then the most profound disciples of science should not criticize us for trying some other method more simple, more practical and more effective. Of course it is difficult to estimate the value of any treatment for Hay Fever, since many recover automatically at about the age of forty years. The administration of chloroform will often give an asthmatic or hay fever patient relief for months. A surgical operation of almost any kind on the nose or abdomen, or anywhere, often gives temporary relief in a way similar to the relief experienced by epileptics after an operation or snake bite. The most persistent case the author ever knew recovered in spite of all treatment at the age of sixty. Since patients rarely if ever die from hay fever or even asthma unless complicated, these disturbances must be considered more of a functional nervous disorder than an organic trouble. Although closely related Asthma may yield to general medicinal treatment while Hay Fever is rarely if ever benefitted much by such treatment, and as a rule is accentuated by any form of local treatment such as commonly used in the treatment of catarrh. The most diagnostic things about Hay Fever are the hypersensitive areas in the nose which are with few exceptions located at the anterior and posterior ends of the inferior turbinates and the adjacent areas on the septum. These areas seem to represent what we might call areas of focal irritation, from which all other nervous disturbances seem to radiate. A histological examination shows the sensory nerve endings in these areas protruding through the mucous membrane associated with more or less erosion of the columnar cells. Any medicinal or chemical irritation of these exposed nerve endings is usually quickly followed by a hypostatic congestion of the submucous cavernous tissue, the entire mucous membrane becomes swollen as if nature was making an effort to withdraw and cover the exposed nerve filaments. All the surrounding sensory system is sympathetically affected and stimulated; the lachrymal glands and all adjacent mucous glands become exceedingly active. The olfactory nerves are excited, although it has no termination in these hypersensitive areas. The olfactory nerve is distributed to the upper half of the septum, the superior turbinate

and the upper half of the middle turbinate. Almost any mechanical or chemical irritation of these hypersensitive areas will bring on the ordinary symptoms and signs of Hay Fever and also Asthma if the patient is affected with the associated trouble. We can understand therefore why there are no local applications which can give even temporary relief except those which temporarily anaesthetize these sensitive areas, such as a solution of cocaine, which acts directly on the nerve endings, or an adrenalin solution which no doubt gives temporary anaesthesia to these nerve endings by a contraction of the mucous membrane sufficient to produce some pressure anaesthesia. Cocaine no doubt produces some of its anaesthesia by pressure effects, then contraction of the mucous membrane.

Alcoholic injections act by apparently giving a more or less permanent anaesthetic effect to these sensitive areas. The more sensitive these areas the more surely will the alcoholic injections cause a subsidence of the symptoms. Such injections no doubt produce a degeneration of the exposed sensory nerve terminations similar to that produced by injections of neuralgic nerves, with alcohol, but no deterioration of the sense of smell. From 5 to 10 mm. of an 8 % carbolized alcohol should be injected into the submucous vascular tissue of the areas in question, and nowhere else. The operation is painful for a few minutes, but of no particular consequence unless the injecting needle enters the perichondroum when the absorption of the alcohol is slow, the pain prolonged and have poor results obtained, as the alcohol does not come into contact with the nerve fibers in sufficient amount or strength to produce the desired effect. It is best not to inject these areas with any local anaesthetic before the alcoholic injections are made, because the tissues are dilated with water and the effect of the alcohol is diminished. The writer uses an ordinary hypodermic syringe and needle for injecting the anterior areas with addition of a tonsil extension and a curved dental needle for the posterior areas going up back of the palate through the pharynx. Almost any combination of accentuated symptoms may follow during the following 48 hours after the treatment. The patient needs considerable encouragement for a few days, although the results are often as immediate as when a neuralgic nerve has been injected. By the end of a week the patient has experienced all the benefits which he is likely to receive. These are usually gratifying if the treatment is confined only to those cases in early adult life who possess the hypersensitive areas. Although the writer has not treated more than a dozen cases in his private practice, he has been

using the method at a clinic held on Saturday at the University of Southern California, where it has been impossible to keep in touch with cases in a way to estimate the permanency of the results. If the effect is similar to that of nerve injection for neuralgia the results may be permanent, but a relief of from six weeks to six years is worth while. This method is certainly to be recommended in selected cases because (1) It gives relief. (2) It causes no sloughing of tissues or destruction of the columnar epithelium and mucous glands such as must necessarily follow the cautery, crush or destructive methods formerly employed which invariably resulted in a destruction of the columnar epithelium and a replacement of squamous epithelium. The ordinary function of the nose is not disturbed. The sense of smell and the secreting glands remain more nearly intact than by any other local treatment. The principle is now as positively established that as little tissue should be removed from the nose for any trouble as that the tonsils and adenoids should be entirely removed. In the atrophic stage of any nasal trouble later on there is apt to be too much dryness, too much space for the passage of air and too small amount of secretion.

Conclusions. Conceding that the largest class of Hay Fever cases is caused by the protein of pollen, foods, fur or feathers acting on hypersensitive areas of the nose, the vaccine method of treatment is largely out of the question in this locality. The alcoholic method is effective on cases associated with hypersensitive areas in the nose in the early adult life. The alcoholic method reduces these hypersensitive areas and thus reduces the foci of irritation which must be present in order that the exciting agent can act. The method produces no sloughing, no destruction of the nasal tissues, no deterioration of the sense of smell. The results of this treatment warrant its use in selected cases. The permanency of the results has not yet been determined.

THE CALIFORNIA ECLECTIC MEDICAL JOURNAL

The Official Organ of the Eclectic Medical Society of the State of California, the Southern California Eclectic Medical Association and the Los Angeles Eclectic Medical Society.

Contributions, Exchanges, Books for Review and all other communications should be addressed to THE CALIFORNIA ECLECTIC MEDICAL JOURNAL, 819 Security Building, Los Angeles, California. Original articles of interest to the profession are solicited. All rejected manuscripts will be returned to writers. No anonymous letters or discourteous communications will be printed. The editor is not responsible for the views of contributors.

THE 1920 "FLU"

Again the "flu" is in our midst. To be sure, it is not quite the same "flu" that we had last year, being of a milder type. However, no one is objecting to this phase of its expression. A less percentage of cases are complicated with pneumonia and these cases are not virulent. On the other hand, the alimentary tract suffers more than last year, particularly in children. This complication is severe and protracted, though the mortality rate is not high. The indicated remedies are the same as those so successfully used last year. For the respiratory type, Gelsemium still heads the list, with Eupatorium a close second. For the alimentary type, Glyconda is the remedy most often indicated.

X-RAY THERAPY

By Robert Knox, M.D., Edin., M. R. C. S., L. R. C. F.

Consulting Radiologist, Great Northern Central Hospital; Honorary Radiologist, King's College Hospital; Director, Electrical and Radiotherapeutic Department, Cancer Hospital (Free) London

The proper appreciation of the value of radiations in practical therapeutics is, to those unacquainted with the subject, very difficult. Opinions vary amongst surgical and medical experts to an astonishing degree. Such opinions are sometimes expressed on scant knowledge of the matter especially of the technique and the action of radiations upon the tissues, and oftener on the results obtained in the treatment of quite unsuitable cases. Perhaps a still more confusing factor is presented by the conflicting opinions of experienced radiologists who may be over-enthusiastic in their claims for the efficacy of the agents they employ, and who may not have had a very extensive clinical knowledge of the diseases they are called upon to treat. Lastly, the new agents were quite early in their history called upon to cure diseases which had completely baffled all other known methods. Little wonder that the results should have been scanty, and that so many conflicting opinions on value have been formed and expressed.

In this paper I shall endeavor to give a summary of X-ray therapeutics and describe the technique for a number of diseases which benefit from radiation treatment. It will be impossible to discuss the instrumentation or the physics of the subject. The former is best learned by a few visits to an X-ray department. The latter calls for an extensive practical knowledge of physics.

The X-Rays and the Structure of Matter

The far-reaching effects of the discovery of X-rays and the subsequent isolation of radium were at the outset hardly recognized. Kayne, in his introduction to his admirable book on X-rays, says:

"In the early nineties it was not infrequently maintained that the science of physics had put its house in complete order, and that any future advances could only be along the lines of precision measurement. Such pessimism has been utterly confounded by a sequence of discoveries since 1895 unparalleled in their fundamental nature and promise. Even many not specially concerned have had their attention directed to the recent attempts at solving the riddle which has excited interest and taxed ingenuity since the beginning of civilization—the problem of the ultimate structure of matter.

"The chemist and physicist have long built upon a theory of atoms and molecules, though information as to the existence and behavior of individual atoms was based only on speculation, however justifiable.

"But within the last decade we have not only isolated the atom but we have learned a great deal about its internal structure. Radio-activity has, for example, introduced us to an electrical charged atom of helium (the a-ray) with characteristics such that it can, in spite of its extreme smallness, make individual appeal to our senses.

"The speed of the a-rays is so abnormally high that if, for instance, they are allowed to strike a fluorescent screen, as in the spinthariscope of Sir William Crookes, each atom possesses enough energy to record its arrival by a single flash of light. Rutherford and Geiger have actually recorded the arrival of atoms by means of a delicate electrometer. C. T. R. Wilson has succeeded in rendering visible and photographing the paths, not only of single charged atoms but of electrons and X-rays as well.

"These are interesting phenomena, and the closer study of their production and characteristics led to the further discovery of electrons by J. J. Thomson and of the X-rays by Roentgen.

"Through the efforts of a band of workers the Roentgen rays have thrown a searchlight on many phases of atomic physics not susceptible to other methods of attack. Quite recently X-rays have come to the aid of the crystallographer and displayed in the hands of Lane, Friederich and Knipping, Bragg, and others, the regular grouping of the atoms in a crystal.

"The Geissler discharge tube known as the Pluoker Hittorf or Crookes tube—the former beautiful plaything of the scientist—has proved the pioneer of some of the most wonderful discoveries and speculations that physical science of this or any generation has known."

That is, in brief, a summary of the events leading up to, and including, the discovery of X-rays. These have, as can readily be seen, revolutionized our conception of the atom.

Achievements and Possibilities of Radiations in Medicine

The great advances in physics rendered possible by the accidental discovery of X-rays by Roentgen have their analogue in the field of practical and experimental medicine. The immediate adoption of X-rays all over the world by medical men working with physicists soon led to an appreciation of the value of the new agent.

No one at the outset could have foretold the immense

strides the new agent would make in the short space of two decades. The use of X-rays in diagnosis has been increased, and many important advances have been made as experience accumulated and apparatus was improved.

Far more interesting has been the gradual unfolding of the possibilities of radiations in therapeutics. The developments up to the present have been enormous. Still greater discoveries may lie before us, especially when, as a result of more extensive and intensive research, better understanding of the method of action of radiations in their application to the treatment of disease is arrived at.

It is necessary to indicate the ever-increasing field of activity before we attempt to deal with the technique and description of cases suitable for treatment. X-rays when skillfully used can influence practically all the tissues which go to make up the living organism, the degree of action depending solely upon the quantity of radiation used and the response to it of the tissue affected. Here we have the possibility of acting upon one or all of the tissues by an agent of great power. Obviously the action must be a general one, whose activities are at present only vaguely understood. So far we know that definite results follow upon definite doses of radiations, and if this fact is grasped we go a long way towards a comprehension of the governing principle of radiation therapeutics.

Medicine, however, is not an exact science, and rules or laws which have a definite value in physics are not so readily applied to the practice of medicine. So far the applications of radiations in medicine are more or less empirical.

As already stated, the striking discoveries in physics have gone a long way toward explaining problems which have perplexed the human mind since the dawn of early civilization. Possibly when our knowledge extends, and a thorough grasp of the physics of these agents and the underlying principles which govern their action has been obtained, it will lead to the development of a thorough technique and to a great improvement in the results obtained by their application to morbid conditions.

The developments may even be as revolutionary in medicine as they have been in physics. It may be even that the discovery of an underlying principle in cell metabolism may give us (by the aid of physics) the clue to the causation of certain diseases which have been the torment of many generations of medical men. Certainly the future teaching in the medical sciences must take more notice of physics. Medical education may be revolutionized in this way, and many of the

now recognized and apparently well established laws in medicine may, in the light of further research, require to be reviewed and possibly seriously modified.

Effects of Radiation on the Living Cell

A great deal of valuable work has already been done in regard to the behavior of the living cell when exposed to radiations. Coldwell and Russ have given us a valuable work in "X-rays, Radium, and the Living Cell," which clearly sets forth the greater effect which can be produced by radiations on cellular structures.

A thorough appreciation of the action of radiations upon the normal tissues will be valuable when we come to deal with morbid conditions. What we know now is very limited, and the result of the application of measured doses. Dealing with the subject broadly, it may be stated that if a particular cell or a group of cells be exposed to a beam of radiations from any source, and in this example we will assume that the radiations emanate from an X-ray tube, certain events may follow: (a) The cell may be stimulated; (b) its activities may be inhibited; (c) the cell may be destroyed.

The determining factor in the production of any of these ends so far as the radiations are concerned is the intensity of the radiation and the duration of the exposure. The former is governed by certain physical data which it is unnecessary to enumerate now.

In regard to the cell, the determining factor will be the resistance the cell possesses to external stimuli. Cells vary enormously in this respect, and, further, individual cells of the same type vary in a direct ratio to the stage of activity they are in when treated by the radiations. This is, in fact, the most difficult of the problems one encounters when estimating dosage.

It can readily be seen from a consideration of these facts how many and varied may be the results from a single exposure to radiations. It also indicates that treatment by radiations must of necessity be solely in the hands of experts whose training will enable them to obtain the maximum of good, and, what is of equal importance, the minimum of harm, in the treatment of diseased conditions.

It is clearly demonstrated that changes can be induced in cellular structures, and these might be described as the direct effects. There are, however, **indirect effects** produced which may have a far-reaching influence upon the metabolism of the organism. The human frame is a complex machine with many systems in full activity, each acting in sympathy or co-ordination with the others. Consequently when a par-

ticular group of cells which go to make up the area treated is acted upon by a measured dose of radiations various effects of an indirect nature are induced. If the dose is excessive, cell activity is arrested and the cellular structures die. The destroyed cells are absorbed or rendered inert by the activity of the surrounding tissues. When absorption takes place the products of disintegration are carried by the lymphatics to other organs in the body. Far-reaching effects may follow. The term "reaction" is applied to this phenomenon. The reaction may be severe and a rise of temperature lasting for several days may occur. This is obviously due to a powerful action upon the tissues. Products of disintegration of tissues may be circulated in the blood and serum and produce beneficial or harmful effects. If the former, the tissues are toned up and the patient improves. If the latter, the patient may be reduced to an extreme degree. This is specially liable to occur in the treatment of diseases of the blood, such as leukaemia, where, if care is not exercised, a rapid fall of the white cells may lead to a fatal leucopenia.

There are many interesting phenomena induced by radiations which could be discussed at great length, but time forbids.

In dealing with a subject of such scope and interest it is somewhat difficult in a single lecture to give an adequate description of all the points of interest, and much of value must be left to another occasion. What, I imagine, will be of the greatest value, will be a brief consideration of the practical application of radiations to the treatment of diseases, with short descriptions of technique and a summary of the value of the radiations in their application to particular diseases. These are numerous, since, as has been shown, X-rays may influence practically all the tissues which go to make up the complex mechanism of the human frame.

The Treatment of Diseases of the Skin

The diseases of the skin are particularly responsive to regulated doses of X-rays. The proof of this lies in the fact that many skin specialists include in their armamentarium an X-ray outfit, and, judging from the results produced by its use, it is not the least valuable of the agents employed. The treatment of skin diseases by X-rays has led to the production of the radio dermatologist, because it is evident that in this branch of medicine there is ample room for another specialist. I shall, therefore, not labor the point.

Suffice it to state that in the treatemnt of **ringworm of the scalp** X-rays are very valuable. The technique has to be very

thorough to produce accurate results. The method is not free from danger. Untoward results are not unknown. These are dermatitis and permanent alopecia. In view of the possibility of such results it is well to caution the parents of children undergoing X-ray treatment that there is danger. The percentage of accident is small but it does occur, and we must admit the possibility of such regrettabe consequences.

Dr. Adamson is responsible for the introduction into this country of a method of exposure which in skilled hands yields satisfactory results. It consists briefly of the division of the scalp into five areas, each of which gets a measured dose.

A number of other diseases of the skin are amenable to skillfully applied doses of X-rays.

Rodent ulcer very frequently calls for X-ray treatment and the results are, on the whole, an improvement on those obtained by other methods. Operation offers in the early case a better prospect of cure. X-ray, however, quickly heals the ulcer. There is a tendency to recrudescence, and it is not at all uncommon for a case to require treatment extending over several years at intervals. On the whole, it is better to treat rodent ulcer with radium. The dosage is more accurately controlled ,and the results are better and tend to be more permanent.

Malignant diseases of the skin.—The technique employed should be that for malignant disease generally, though in cases of superficial epithelioma and a number of cases of rodent ulcer unfiltered radiations may be used for the earlier doses, a gradual increase of the thickness of the filter being employed to ensure the adequate irradiation of the deeper structures.

Hyperidrosis.—This troublesome condition readily yields to radiations. It should be more widely employed than it is at present. The result can be obtained by one or two large doses at an interval of two to three weeks between the exposures, but it is sound policy to aim at a slower production of the effect. Three or four exposures of each axilla at intervals of three weeks should lead to an arrest of the excessive perspiration. The aim should always be to control rather than to suppress the secretion. The technique is simple. The patient lies on a couch with the arm extended over the head, and the avilla is thoroughly irradiated with unfiltered radiations. Subsequent doses should be given through an aluminum filter.

The Treatment of Enlarged Lymphatic Glands

The growing experience in the treatment of enlarged glands is forcing upon us the conviction that in X-rays we possess a remedy of great power. During the course of investigations, extending over many years, into the action of radi-

ations upon tissues, I have found that the behavior of the enlarged lymphatic glands, of whatever nature, is such as to indicate unmistakably that the effects may be far-reaching. X-rays and radium have been extensively employed in these investigations. Either will succeed if the proper dosage is administered. The response in a large number of cases has been very marked and almost invariable, the chief matter being the selection of the suitable radiation for each condition dealt with.

Diagnostic Value of X-Rays in Enlarged Glands

It is so certain that several types of enlarged glands will respond to radiations that we might employ the rays in a diagnostic as well as in a therapeutic sense. It has been observed that enlarged glands respond in somewhat like the following order to estimate doses of radiations:

1. Enlarged glands due to simple inflammatory conditions give a very rapid response if suppuration has not set in and the condition is becoming chronic.
2. Lymphadenomatous glands give a fairly rapid response, but not so rapid as the simple inflammatory ones.
3. Sarcomatous and lymphosarcomatous glands give a rapid response in the majority of cases treated, leading to a rapid diminution in the size, but the effect is rarely permanent, there being a tendency to recurrence, and an ultimate refusal to respond to further treatment.
4. Tuberculous glands give a slow response as a rule. When treated early enough the glands become quiescent and slowly subside, but if not completely fibrosed they tend to break out at a later period.
5. Carcinomatous glands give a very slow response. They hardly ever completely disappear, but they may be arrested in their growth. It is, then, sound practice to remove the glands surgically.
6. Enlarged glands due to a mixed infection are fairly common. For example, in a patient suffering from carcinoma in an adjoining area the glands may enlarge in groups and yet no secondary cancer be present, or the glands on the opposite side from the lesion may become enlarged. These will quickly subside under radiation treatment. All, or nearly all, may disappear, or one or more in a group of enlaged glands may persist. These may ultimately be found to have invading cancer cells in their substance. Only a few groups of cells may be found, the bulk of the enlargement being due to inflammatory reaction, and there may be a secondary infection due to other organisms. The same condition may occur in tuberculosis. A group of glands may have only one or two which

are actually invaded by the tubercle bacillus. In both of these instances, if the glands are treated by X-rays, a mixed response is obtained.

From a consideration of the above statements it is obvious that in X-rays we possess a differential diagnostic test which may be extremely useful when we are in doubt regarding the nature of the casual condition.

Therapeutic Radiation of Tuberculous Glands

The irradiation of enlarged tuberculous glands is useful for other purposes than that of the glands alone. Co-existent or chronic tuberculosis of the lungs may at the same time receive benefit from the radiations, and it is a matter for serious consideration whether all such cases should not have radiations applied as a part of the routine treatment.

A considerable amount of this class of work is being done, and it will be interesting to have later a report from sanatoriums which have adopted the method. The general tonic action of radiations should also be helpful in these cases.

The treatment in all cases of enlarged glands must be thorough. In sanatoriums where the patient is at rest and under observation, daily doses may be given, a fresh area being selected each day and the exposure repeated to the same area not oftener than once in 14 days. The aim in tuberculosis cases should be to include the thoracic contents, particularly the medeastinal gland, in the field of irradiation, so that all deep glands may receive adequate exposures. In less acute cases the treatment may be given once or twice a week. The dose at each visit will vary with the condition requiring treatment. Tuberculous glands require to be treated for a lengthy period of time extending over many months.

Enlalrgement of the Thyroid and Thymus Glands

There are no groups of clinical symptoms, such as occur in exophthalmic goitre or Basedow's disease, which call for more skillful treatment than those associated with disorders of the thyroid and thymus glands. The combined skill of the clinician and the radiologist is necessary to combat successfully the complex phenomena exhibited in this disease. There can be no question that a combined attack, using all the measures available, will enable us to check the symptoms and ultimately cure the disease in a number of cases. These vary in the degree of acuteness, and the treatment will require to be varied accordingly, if a successful issue is to be looked for. Sanatorium treatment combined with medicinal measures and radiations affords us the treatment **par excellence.**

The very acute case demands absolute rest in bed, quiet,

careful diet, fresh air, and practically a continuous action from radiation treatment. Small doses of the latter daily may be required over several weeks before any sign of improvement shows itself. Later, when the severity of the symptoms abates, the treatment should be gradually diminished in intensity and frequency, and when the metabolic balance is gradually restored the dosage may be reduced to three times a week, and, later, given at longer intervals.

X-Ray Treatment in Exophthalmic Goitre

Three areas of the thyroid gland should be irradiated, one on the right side, another on the left, and a central large area should include the isthmus of the gland and the upper thoracic region, the object being to include the thymus gland, which is generally enlarged in these cases. Experience has shown the value of including the thymus in the irradiated area. It is well to use filters of 2 or 3 mm. of aluminum, and in addition a secondary filter to protect the skin. The latter should always be carefully protected from over dosage, because if this should occur, even to a slight extent, it may be followed later by teleangiectasis, which is a troublesome complication.

Treatment should be continued at intervals over a long period of time in these acute cases. Patients complain of a tendency to relapse if this is not done, and it is quite possible to maintain the balance of activity of the gland by such treatment.

Fortunately the majority of cases treated do not require such systematic treatment. There are many patients who are not acutely ill, and though these would improve more rapidly under the stricter regime, circumstances may not allow of such vigorous treatment and it may be necessary to treat these patients at an out-patient clinic. Several hundreds of such cases have been treated by visits of once, twice, or three times a week. The dosage is similar to that described for the more acute cases, and the treatment requires to be carried on over many months. In the majority of cases the progress is satisfactory, there being a gradual restoration of balance of health, a diminution of the symptoms, and a slow but steady reduction in the size of the enlarged gland.

Better results in the more chronic cases have been obtained by the administration of small doses at frequent intervals than when the larger doses were given at intervals of three to four weeks. It is not necessarily cases of very large thyroid glands which respond most readily. The aim of treatment is to regulate the secretion from the gland, and a small gland may be very active. A regulating dose may check the activity, and so influence the condition.

Parenchymatous Goitre and Other Conditions

Another form of enlarged thyroid met with is the parenchymatous goitre, where the chief disturbance is due to the enlargement, with few or none of the general disturbances. These cases require careful treatment, the gland being very difficult to treat, and the reduction in size being very slight and very slowly induced.

A number of these cases appear to respond more rapidly when radium is used. Possibly the tissues are more resistant because the enlargement is due to a general increase of the structural tissues as against the glandular hyperplasia with over secretion in the cases of exophthalmic goitre the claim of surgery should always come first in treatment.

Malignant disease is another form of enlargement of the thyroid. This is very untractable to radiation treatment. Operation, if possibe, offers the best chance of cure in those cases. Failing this, radium should be used. Large quantities of radium are required, and the filtration should be through 3 mm. or 4 mm. of lead or 2 mm. X-rays of a penetrating type may also be useful.

Enlargement of the thymus in children frequently requires treatment. X-rays will be found useful in these cases.

The Treatment of Diseases of the Blood and Ductless Glands

X-rays may be employed in the treatment of a number of these conditions. In dealing with the diseases of organs affected by morbid growths the skin receives a large percentage of the radiation and it has been noted that in this way the blood while circulating in the tissues receives a dose which may exercise an influence far-reaching in its action not only upon the constituents of the blood but on the tissues through which the blood circulates.

It is, therefore, a good practice to irradiate large areas of skin surface as well as the spleen and the bone marrow when dealing with diseases such as leukaemia. When it is necessary to get a rapid action the greater part of the surface of the body may be utilized for this purpose. Patients who have been treated for other diseases show upon examination a marked improvement in the blood. This is known by an increase in the percentage of haemoglobin and a raising of the color index, and if a blood count is taken it may show a marked increase in the percentage of the red blood corpuscles. Patients who have been treated by X-rays for fibroid of the uterus frequently show this marked improvement in the condition of the blood. The change is, however, due to other causes. For instance, the checking of the excessive haemorrhage induces an arrest of the secondary anaemia which accompanies it.

Patients treated for cancer also frequently show an improvement in the blood condition, evidenced by an increase in the number of red cells and a nearly normal color index. These improvements undoubtedly occur, though they may be only temporary.

Most of the diseases in which there are blood changes have been subjected to radiations in the hope that benefit might accrue. Evidence exists which proves that it is possible to exercise a considerable influence upon a number of these diseases. Leukaemia generally responds for a time at least to radiations, and there is no reason to assume that the improvement is only a variation in the course of the disease. The effects are too marked and exist for too long a period for this to be so.

Technique for Diseases of the Blood and Ductless Glands

This will vary with the effects we wish to produce. If a rapid action is required it should be the aim to induce a profound effect upon the blood cells. This can best be done by irradiating large areas of the skin surface with very lightly filtered rays. The first inch of tissues below the skin absorbs about 75 per cent of the total of these rays, and consequently if the blood-supply is up to the normal the percentage of radiation absorbed will be considerable. When deeper effects are likely to be more helpful then more penetrating radiations may be employed. A filter should be used to absorb a percentage of the softer radiation.

For the irradiation of the spleen and other deep organs filtered rays are employed, the filter in this case being used to protect the skin, which is likely to receive large doses of rays if repeated applications are required.

The Treatment of Diseases of the Pelvic Organs

Early in its history the extension of radiation treatment took in the diseases of the uterus and attention was particularly directed to the enlargement of the uterus arising from fibromyoma. The effect upon these structures was led up to by experimental work carried out in 1905 by Halberstader, who first noticed atrophic changes in the ovaries of rabbits as a sequel to irradiation by X-rays.

Similar observations were made by Bergonie, Tribondeau, and Recamier. Reifferschceid described changes occurring in the human ovary as a sequel to irradiation by X-rays and subsequently operated upon. Many other observers have recorded changes produced in the ovary as a result of prolonged X-ray treatment. The majority of the results given are presumably those produced by relatively small doses of X-rays, and no details are submitted as to the penetrative quality of the ray

or the filtration employed. Albers Schonberg, Henish Bordier, and later Gauss and Lembekte, give results obtained by the more intensive form of treatment, the latter having worked out a very extensive technique, using filtered rays of moderated penetration, and giving results showing improvement as the intensity of the dosage increased.

Later work in America and England on intensive lines has given improvement in results altogether greater than was at one time thought of. The advent of the Coolidge tube and apparatus capable of exciting it adequately have further improved the technique and put within our reach the possibility of administering fairly large doses at a considerable depth from the surface of the body. Further, the introduction of many ports of entry and the angling of the tube to focus the beam of rays upon a given part have rendered it possible to increase greatly the dose at a given spot. The ovary on either side is taken as the landmark upon which the rays should be focussed.

Mode of Action of the Radiation

The action of the rays appears to be primarily exercised on the ovary and its blood supply, suppression of function leading to atrophy of the structure and cessation of the menstrual haemorrhage. The latter is the most troublesome symptom arising from fibromyoma. The improvement in the patient's health may in fact be attributed to the cessation of the haemorrhage. The atrophy of the ovaries is, however, accompanied in a number of cases by a diminution in the size of the tumor. It is reasonable to assume that an action is exercised on the tumor itself. It is therefore, advisable when treating the ovarian areas, to include the tumor as well.

The anterior abdominal wall is mapped out into a number of areas. The tube is arranged in treating each area so that the beam of rays may be focussed upon a given spot. If each ovary gets the maximum effect from those "ports of entry" on the side in which it lies, the tumor also receives a very large proportion of the radiations passing through it. A part of these radiations being absorbed by the tumors, changes must therefore occur in its structure as a result of the dosage it receives.

Whatever the action may be and upon whichever structure the rays act most, there is no doubt whatever that in the treatment of those conditions many marked beneficial results can be obtained by carefully applied courses of radiations. It will therefore be necessary to describe in some detail the technique now employed, the type of case likely to benefit, and to analyz the results obtained.

Technique for the Treatment of Fibromyoma of the Uterus and Other Conditions of the Pelvic Organs

The technique, although chiefly employed for the treatment of fibromyoma, may be also applicable to such conditions as tumors of the other pelvic organs, and in the prophylactic treatment of cases of new growth after removal. It is also applicable in a modified form for the treatment of conditions such as endometritis, fibrosis of the uterus, and for the production of sterility in conditions requiring such treatment.

With a modern installation the Coolidge tube offers advantages over any other tube in use. By using a high-tension transformer with the tube a uniform series of exposures can be readily and rapidly carried through. The heating current is adjusted to give the desired penetration and the whole series of irradiations can be administered under precisely the same conditions. The dose should be measured by the Sabouraud and Poirépastille, or by a photographic paper, or by any method which is known to be reliable.

A filter of at least 3 mm. of aluminum is used, and it should be placed, if possible, midway between the tubes and the patient's skin. The secondary filter, consisting of chamois leather, several layers of thick paper, and loofah sponge, enclosed in a linen bag for convenience, is placed upon the skin under the tube box. The time taken to produce the tint B varies with each installation, and the current is capable of passing through the tube. An average of about five minutes to each dose can easily be obtained, using 2-3 ma. in the coil circuit. If the current is increased the time will be shortened proportionately to the amount of the increase in the intenisty. A "hard" ray is necessary. Between 8 and 9 on the Baner qualimeter is a useful radiation to employ in these plevic conditions.

The anterior abdominal wall is marked out into a predetermined number of areas, the landmarks used being the level of the umbilicus and the public arch. As many as 20 ports of entry can be utilized in this way. In addition, the areas may be extended into the lateral wall of the abdomen and the posterior aspect. These extra areas are useful when it is necessary to get in a very large dose quickly in acute cases. Each area receives the same dose of radiations.

The Question of Dosage

It is advisable to commence the treatment just after the cessation of the menstrual period in cases where that is possible. The whole of the areas may be treated at one seance where it is necessary to do so, but from experience it has been found that it is better to divide the dose into two or three days. This diminishes the exhausting action on the patient

arising from the continuous treatment of one or two hours or more, and lessens the after-effects upon the patient.

The aim of treatment is to produce the result gradually, so it is necessary to give three or more seances before the patient is really benefited. It is quite possible to produce a result in one or at the most two seances, but the effect on the patient is often very injurious for a time, as serious reaction may be induced when the very intensive line of treatment is adopted. As a rule, in the average case a satisfactory result may be looked for in from 3 to 6 seances, each consisting of 10 to 12 areas. It is not at all uncommon for the period after the first seance to be more excessive than those before the treatment, so it is necessary to caution the patient on this point if she is not to be discouraged and discontinue the treatment.

The improvement is gradual, beginning, as a rule, after the second series of treatment. The menstruation or haemorrhage generally ceases after the third series and may not be seen again. It is, however, advisable to administer one or two further series in order to keep up the action.

Immediate and Later Effects

There are certain conditions produced by the treatment of which the practitioner should be cognizant if he is to be in a position to advise his patients on these and other points of importance arising in the course of treatment. Of these the most important is the so-called reaction induced by the effects of the radiation. These may be divided into (a) immediate effects, (b) later effects (reaction, etc).

Of the **immediate effects** nausea is most common. This is probably due to the inhalation of highly ironized air, which is invariably found in the vicinity of high-tension electrical machinery and possibly to the generation of ozone in the vicinity of the active X-ray tube. Headache is often met with and is attributable to the same causes. Giddiness is a common symptom and may be directly traced to change of posture, most patients suffering temporarily and briefly from this when they arise from the X-ray couch. Patients frequently go to sleep while being treated. This is possibly due to the monotonous hum of the active electrical apparatus.

The remedy for most of these conditions is simple. For faintness a small dose of sal volatile will suffice. Eau de Cologne sprinkled on a towel and laid over the patient's face will serve to minimize the effects of the ozone and ionized air. An electrical fan in the near vicinity of the tube will quickly change the air and carry off some of the ionized air. In prolonged treatments a little oxygen in an inhaler will revive the patient.

The **later effects** come on several days after the treatment, and their appearance has a direct relationship to the intensity

of the dose. In large doses it comes on earlier, possibly the next day, but in the average not for two or three days. In cases where the dosage has been very heavy intense prostration may follow, with rapid pulse, raised temperature, and feelings of malaise. The temperature may rise to 103° and 104° and remain at this limit for some time, when patients may become extremely ill. The treatment consists of rest in bed and careful attention to diet. Medicinal treatment should be used as the symptoms indicate.

The patient generally recovers in time for the next series of treatment, which is due, as a rule, in about a month from the preceding one. Generally a degree of tolerance to the treatment develops and the patient shows hardly any reaction to subsequent doses, but a number of patients never acquire this tolerance and dread the repetition of the treatment on account of the distressing symptoms it produces. In these cases it is probable that the dosage has been too great for the patient's general resistance. The after-effects may in these cases be minimized by giving the treatment at longer intervals, or giving smaller doses and carrying the total amount over a longer period.

Type of Case Likely to Benefit from X-Ray Treatment

Although it may be assumed that tissue changes may be induced in practically any form of pelvic disease, and that in a number of these the action will be beneficial, yet for practical guidance it is necessary to survey carefully the field of usefulness and indicate where radiation treatment is likely to give better results than other methods such as the operative, where it is likely to help towards a cure when combined with the operative and other forms of treatment, and particularly to indicate when it is wise to hold one's hand and decide against X-ray treatment. This involves a resume of the conditions met with, particularly in the present instance with regard to fibromyoma.

While it has been admitted that up to the present the interstitial fibroid is the most suitable for radiation treatment, several writers have pointed out that practically all forms of fibroid respond favorably. The small tumor is more likely to become amenable to treatment than the very large tumor which fills the pelvis and the greater part of the abdomen. It is also worthy of note that the majority of the patients submitted to X-ray treatment have been for one reason or another unsuitable for operation. Hence the results secured in a number of cases have been obtained in patients who were too bad for operation, and therefore presumably not favorable subjects for any form of treatment from the curative point of view.

A typical instance of this is found in the case of a patient

who was rapidly sinking from profuse haemorrhage, and who in the earlier stage of her malady refused to submit to operation. Later, when she was willing to do so her condition was so grave that the surgeon refused to operate. As a last resource she was taken to an X-ray department in an ambulance. Treatment was pushed vigorously and in a short time the patient was out of danger. Later she made a complete recovery.

Sir John Phillips in a valuable paper states that he has used X-rays in nearly all forms of fibroid with beneficial results.

Any case of fibroid tumor will be benefited by radiation treatment if the symptoms are not urgent enough to call for immediate operation. The need for operation may be determinded by: 1. The amount and frequency of the haemorrhage and the secondary effects upon the patient. 2. The size of the tumor and rate of growth. 3. The pressure effects upon other structures. Even in this class of cases radiotherapy may achieve results if the patient is willing to risk the effect of very intensive treatment and any other danger incident to its use.

There are other factors, such as the age of the patient, which may be taken as a guide to the practitioner in these cases. Till recently it has been said that patients under 40 years should not be treated by X-rays or radium. More recently it has been found that at any age the patient may be beneficially influenced, and that if modified results are all that are required it is possible to produce them. Instances of this kind will be met with in severe dysmenorrhoea associated with an infantile type of uterus. Such patients should be warned of the probable complete cessation of menstruation if the treatment is pushed to its limit.

There are other conditions than fibroids, such as menorrhagia from any cause and endometritis, which may be influenced by treatment.

Put briefly, the advantages the treatment possess over other forms are that it is quite painless, and, if it fails, operative measures may be employed under the same conditions as before or even under improved conditions. It is not accompanied by so much risk as the operative, and the aftereffects are not so disturbing or lasting. Reaction may, however, in a number of cases be rather disturbing. The final result is brought about gradually and the patient is not so seriously affected by the climacteric symptoms induced in both methods of treatment. It is perhaps obvious that if the patient has the whole matter put clearly before her she may patient has the whole matter put clearly before her she may decide upon the radiation method in preference to the operative.

The Treatment of Malignant Disease

The treatment of malignant disease by radiations, as has been shown, is now widely recognized. The indiscriminate use of the method has in the past somewhat detracted from its value. In the earlier X-rays were tried in hopeless cases. Even now we are compelled to resort to their use in cases which we recognize as beyond the reach of any therapeutic agent so far as cure is concerned.

Palliative Treatment

This leads us to the consideration of the palliative use of X-rays in cases which are quite hopeless. Pain may be relieved, tumors are reduced in size, and the general health of the patient improves. The treatment is palliative in another sense, because it must be recognized that in bad cases of cancer, where it is known that the patient cannot be cured, the mental state of the patient has to be considered. Careful use of X-rays in these cases will give an amount of comfort to the patient which is altogether out of proportion to any physical benefit received.

It is pathetic to have to deal with these patients. The hope of benefit, even cure, from, to them, a wonderfully powerful agent, takes possession of them to the end. Patients will struggle to the X-ray room when it is obvious to all that they cannot possibly be relieved of their troubles. How far it is justifiable to encourage these patients I leave to the practitioner to decide. It is, however, noticeable that if nothing at all is done to help these victims they soon lose hope, become depressed, and quickly succumb to the malady.

In this relationship it is remarkable how much response may be obtained in extensive superficial carcinoma involving the skin and adjacent structures. I have seen extensive involvement of the skin clear up under practically continuous X-ray treatment. By this is meant daily doses to numerous areas of skin. The treatment may be carried on for several weeks in this way.

Possibility of Good Results in Very Grave Cases

Cases which are apparently hopeless respond well to the radiations, and a period of good health results. A striking instance of this kind may be quoted.

A man of about 35 had a sarcoma of the right testicle removed by operation. I saw him about two years after the operation. He was nearly in extremis, the abdomen was enormously distended, and there was serious engorgement of the superficial vessels of the anterior abdominal wall. The abdominal cavity was filled by a large mass of new growth, this being nodular and very hard. The legs were oedematous,

and, to judge from the physical condition of the patient, it seemed as if treatment would be useless. However, it was thought advisable to attempt to help the man. Large doses of X-rays were administered to several areas of the abdomen—back, front, and laterally—the idea being to get in a large dose rapidly. Improvement soon set in, the tumors diminished, and the swelling of the legs subsided slowly, this being aided by regular massage to the limbs.

In about three to four months the patient was able to walk. He attended as an out-patient for over a year, receiving treatment at intervals. It is now over a year since treatment was commenced. The patient is at work and is able to carry on, the condition being quiescent. He remained well for over 18 months, when he returned for further treatment.

The next case, although not one of malignant disease, illustrates the degree of influence which can be exercised over a very large tumor.

A patient attended the Great Northern Central Hospital over eight years age suffering from an enormously enlarged spleen, the organ reaching down nearly to the public arch. He was anemic and appeared to be rapidly going down hill. He was admitted to the hospital and received doses of radiations three times a week for a month. At the end of that time there was no visible improvement and the question of removal of the spleen was discussed. I asked that a continuation of the treatment should be advised after a short interval. This was done, the spleen steadily reduced in size, and in about a year had returned nearly to the normal. Treatment at intervals of three or four weeks was administered. When last heard of, about a year ago, the patient was in good health and had been actively engaged in business for about eight years.

These cases are, I admit, exceptionally good from the point of view of treatment. The prognosis in both was as grave as it could be, yet both responded to treatment in a remarkable way. I quote them in support of the treatment of hopeless cases by palliative measures, because we cannot say when a patient will not respond in some measure to the radiations.

In our endeavor to obtain results in these cases we resort to combined treatment by X-rays or radium and the injection of salts of metal in a collodial form. Theoretically the proposition is a sound one, since it is possible to obtain secondary radiation effects from this method. I am quite of an open mind in regard to the value of colloidal salts of metals. I have seen good results obtained, but, on the other hand, the results obtained by radiations alone are equally good.

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